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(54) Title of the invention BULKY NON-WOVEN FABRIC

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SPECIFICATION

1. NAME OF INVENTION

Bulky Non-woven Fabric

2. SCOPE OF PATENT CLAIMS

A bulky non-woven fabric comprising multiple fibers made from two different types of polymers having melting points at least 20 °C different from each other, wherein the high-melting-point polymer structures a core part that has hollow parts and the low-melting-point polymer structures a sheath part, where said low-melting-point polymer is thermally fused; wherein the center of said core part and the center of said hollow part are not concentric with the center of said sheath part, and wherein there is a hollow ratio of between 5 and 40%.

3. DETAILED DESCRIPTION OF THE INVENTION

(FIELD OF INDUSTRIAL APPLICATION)

The present invention relates to bulky non-woven materials obtained through performing a thermal process on a web made from thermal-bonding non-concentric compound fibers, and, in particular, relates to bulky non-woven fabrics suited to medical treatment products hygiene materials, and skin materials such as paper diapers, etc., that have superior bulk and elastic recoverability.

(PRIOR ART)

Conventionally, long-fiber non-woven materials comprised of two components with different melting points are broadly used in, for example, hygienic materials, and there has recently been an increasing demand for low fabric weight.

For example, the long-fiber non-woven material disclosed in Japanese Examined Patent Application Publication S63-282351, [the fibers] are not hollow, and thus there is the drawback that the bulk and elastic recoverability required in the low-fabric-weight field were not always fulfilled.

(PROBLEM TO BE SOLVED BY THE INVENTION)

The present invention ameliorates the deficiencies in conventional non-woven fabrics, or in other words, makes improvements to the uncomfortable feeling due to the reverse flow of fluids in, for example, diapers due to inadequate bulk and inadequate elastic recoverability, doing so without sacrificing the softness, breathability, strength, etc., of the non-woven material, providing a bulky non-woven fabric that is superior in terms of the bulk and elastic recoverability required in the low-fabric-weight field.

(MEANS FOR SOLVING THE PROBLEM)

The present invention employs the following means for solving the aforementioned problem. In other words, the present invention is a bulky non-woven fabric comprising multiple fibers made from two different types of polymers having melting points at least 20 °C different from each other, wherein the high-melting-point polymer structures a core part that has hollow parts and the low-melting-point polymer structures a sheath part, where said low-melting-point polymer is thermally fused, the center of said core part and the center of said hollow

part are not concentric with the center of said sheath part, and there is a hollow ratio of between 5 and 40%.

The present invention is explained in detail below, with reference to the figure.

The compound fibers according to the present invention [each] comprise a core part and a sheath part, where said core part is made from a high-melting-point compound, and have hollow parts, where the sheath parts are made from a compound with a low melting point that is at least 20 °C different from the melting point of the compound of the core part. In the present invention, as the polymer with the high melting point that comprises the core part may be used use, for example, polypropylene or polyethylene terephthalate, and as the compound with the low melting point that comprises the sheath part, high-density, medium-density, or low-density polyethylenes, polypropylenes, ethylene-vinyl acetate copolymers, and the like may be used. As the compound with the high melting point, a compound must be selected and used that has a difference in melting point of at least 20 °C in order to insure thermal bondability when made into a non-woven fabric, and the sheath part must comprise a low-melting-point compound. In this case, if the difference in melting points of the compounds used is less than 20 °C, then when manufacturing the non-woven fabric through thermally fusing multiple fibers, not only would the softness and breathability suffer due to deformation due to softening all the way to the core, but also the bulk and elastic recoverability would suffer due to a part of the hollow part being crushed. However, when a compound is used that has a difference in melting point of 20 °C or more, these problems do not occur, making it possible to obtain a superior non-woven fabric in terms of each of the characteristics of softness, breathability, bulk, and elastic recoverability.

Next, the center of the core part 1 and the center of the hollow part 2 that exist in said core part are non-concentric with the center of the sheath part 3 (Figure 1). This non-concentricity promotes the incidence of crimp during thermal setting, which is required for the creation of bulkiness. In Figure 1, the radius of the core part 1 is r, where, when the distance between the center O_1 of the core part 1 and the center O_2 of the sheath part 3 is defined as W_1, then the non-concentricity ratio W_1/r should be in the range of 0.1 to 0.7. Furthermore, defining the distance between the center O_1 of the core part 1 and the center O_3 of the hollow part 2 as W_2, then the non-concentricity ratio W_2/r should be in the range of 0.1 to 0.7. Non-concentricity ratios W_1/r and W_2/r of less than 0.1 are undesirable because there will not be bulk because of the inadequate incidence of crimping. Conversely, non-concentricity ratios in excess of 0.7 are undesirable because of the danger of the hollow part being exposed to the outside of the core part.

Furthermore, if, in Figure 1, the cross-sectional area of the core part 1 is defined as C and the cross-sectional area of the hollow part is defined as E, then the hollow ratio S is expressed by

$$S\ (\%) = \frac{E}{C + E} \times 100$$

and a value for S in the range of 5 to 40% is required. If less than 5%, then there will be no bulkiness due to the reduction in the constituent volume, and there will not be a large bend moment in the fibers due to the non-concentric hollowing, which is not desirable because there will be inadequate elastic recoverability. On the other hand, when the hollow ratio S is in excess of 40%, the hollow parts are easily crushable under high loads, which is undesirable because it would bring a loss of bulk and a loss of elastic recoverability.

In the present invention, the centers of the core part and the hollow part within the core part are not concentric with the center of the sheath part, and thus there is a synergistic effect due to the non-concentricity of the sheath part and the core part and the non-concentricity of the core part and the hollow part within the core part when performing the thermal bonding, in a non-woven fabric that is formed from fibers with a high incidence of crimp, providing bulk durability with superior bulk in elastic recoverability, even in low-fabric-weight applications.

Because there is a hollow part in the core part, the bend moment of the fibers is large due to the presence of the hollow part even when the sheath part is melted in the thermal bonding processing, making it possible to improve the bulk and the elastic recoverability, while, on the other hand, the non-concentricity of the centers of the sheath part and the core part at the time of the thermal bonding causes there to be non-concentricity of the hollow part relative to the core part causes the sheath part to be melted while crimping occurs, at which time, and because there will be non-concentricity of the hollow part relative to the core part after the sheath part is melted, 3-dimensional volumetric crimping occurs due to the non-concentricity of the hollow part [to the core part] due to the structural anisotropy when the core part is released from the constraint of the sheath.

The result is that a bulky non-woven material is obtained.

Note that excellent elasticity and [elastic] recoverability is brought about by the interaction of the elastic recoverability of the stable fibers themselves with the shape of the fiber aggregation due to the bonding between the fibers in the non-woven material after it has initially been bulky.

Furthermore, even in low-fabric-weight applications, a bulk of 25 cc/g or higher is shown in the non-woven fabric after thermal bonding.

(EXAMPLES OF EMBODIMENT)

Examples of Embodiment 1 and 2, and Comparative Example 1

A polyethylene terephthalate with a melting point of 266 °C and a limit viscosity of 0.63, as the core material, and a high-density polyethylene, with a melting point of 132 °C, a melt index of 28.6 g/10 minutes, and a density of 0.953 g/cm^3, as the sheath material were melt extruded at the respective temperatures of 290 °C and 245 °C, and fiber forming was performing and 290 °C with a continuous fiber forming with an extrusion ratio of 1:1, where [the fibers] were collected on a net after extrusion, under specific conditions, and subjected to processing in hot air (120 °C) without an applied load to produce a specific long-fiber non-woven material. At this time, the fibers were formed with a variety of different cross-sectional areas. The results are shown in Table 1.

Table 1

		Embodiment 1	Embodiment 2	Comparative Example 1
Conditions	Extruding Temperature (°C)	75	75	75
	Extrusion multiplier	3.3	3.8	3.0
Fiber Performance	Fineness (d)	2.8	2.6	0.5
	Dry strength (g/d)	3.3	3.4	3.2
	Dry elongation (%)	88	66	63
	Crimping factor (crimps/inch)	15	13	6
	Crimping ratio (%)	26	25	8
	Cross-sectional profile			
	Hollow ratio of core component (%)	18.8	18.1	30.3
	Non-concentricity $(W_1/r)/(W_2/r)$	0.46/0.61	0.48/0.15	0
Characteristics of non-woven material	Fabric weight (g/m^2)	30	30	30
	Bulk (cc/g)	97	83	20
	Thickness – A (mm)	2.8	1.9	0.9
	Thickness – B (mm)	1.4	1.3	0.2
	Coefficient of recoverability (B/A)	70	69	50
	Tensile strength (kg/5cm)	5.7	5.5	4.0
	Fracture strength (kg)	2.4	2.4	1.8

Note that the melting point refers to the temperature of the peak of the melt heat absorption curve using the DSC measurement method, and is the value measured using DSC (with a thermal ramp of 20 °C/minute), and the limit viscosity is the value measured using an Ubbelohde-type viscometer, the density is the value measured using a density gradient pipette, the melt index is the value measured using a melt indexer, the thickness A (mm) of the non-woven fabric is the value measured under a load of 3 g/cm^2, and the thickness B (mm) is the value measured under a load of 3 g/cm^2, reapplied after five days have elapsed after a load of 35 g/cm^2 has been applied. The coefficient of elastic recoverability (%) is the percentage wherein the thickness B (mm) is divided by the thickness A (mm). The tensile strength (kg/5 cm) is the value measured for the tension, and the fracture strength (kg) is a value measured for the tension.

As can be seen in Table 1, the hollow ratios are fulfilled by Embodiments 1 and 2, and there is non-concentricity, so the non-woven fabric has superior bulk and elastic recoverability. Comparative Example 1 does not have the non-concentricity, and so is lacking in the elastic recoverability and in bulk.

(EFFECT OF THE INVENTION)

The present invention has the following outstanding results:

(1) It is a non-woven fabric with excellent bulk durability because of the high incidence of crimping due to the synergistic effect in the thermal bonding process because the centers of the core part and of the hollow part within the core part are non-concentric with the center of the sheath part.

(2) 3-dimensional volumetric crimping occurs due to the hollow part after melting being non-concentric with the core part after melting the sheath while there is a crimping phenomenon due to the non-concentricity between the sheath part and the core part in the thermal bonding. It is a non-woven fabric with excellent bulk and elastic recoverability due to the excellent elastic recoverability caused by the existence of the hollow part.

(3) The non-woven fabric with this type of bulk and elastic recoverability is ideal for hygiene materials, and, in particular, has the effect of blocking the reverse flow of fluids in the absorption core.

4. SIMPLE EXPLANATION OF DRAWINGS

Figure 1 is a cross-sectional drawing of a fiber with a core-and-sheath structure, having a hollow part, according to the present invention.

1: Core part

2: Hollow part

3: Sheath part

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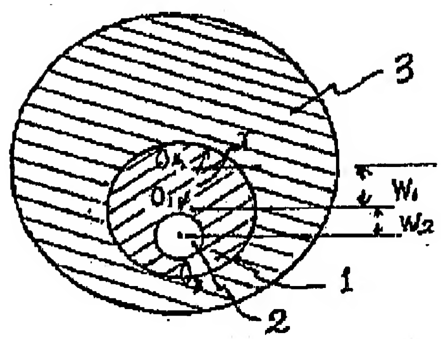
Figure 1



1: Core part
2: Hollow part
3: Sheath part